

CLAIMS

1. A multi-axis piezoelectric positioner comprising:

a fixed part;

5 a moveable part positionable in a plane relative to the fixed part, the moveable part comprising a piezoelectric device operable to expand and contract within the plane; and

10 first, second and third releasable clamp mechanisms operable to selectively clamp the moveable part to the fixed part at corresponding first, second and third locations such that the moveable part may be moved within the plane by selected activation of ones of the releasable clamp mechanisms as the piezoelectric device is expanded or contracted, wherein the releasable clamping mechanisms each comprise a piezoelectric actuator operable to apply a clamping force to the moveable part along a direction perpendicular to the plane.

15 2. A multi-axis piezoelectric positioner according to claim 1, wherein the piezoelectric device consists of a single piezoelectric element.

3. A multi-axis piezoelectric positioner according to claim 1, wherein the piezoelectric device comprises a plurality of piezoelectric elements.

20 4. A multi-axis piezoelectric positioner according to claim 1, wherein the piezoelectric device comprises four piezoelectric elements arranged to form the sides of a rectangle.

5. A multi-axis piezoelectric positioner according to claim 4, further comprising a fourth releasable clamp mechanism, wherein the first, second, third and fourth releasable clamp mechanisms are arranged to act at corresponding ones of the four corners of the rectangle.

25 6. A multi-axis piezoelectric positioner according to claim 4 or claim 5, further comprising corner-pieces at the corners of the rectangle.

7. A multi-axis piezoelectric positioner according to any one of the preceding claims, wherein the piezoelectric actuators each comprise a piezoelectric element mounted in a flexure member and arranged such that the piezoelectric element may be driven to expand in a direction substantially parallel to the plane, thus causing the flexure member to contract in a direction substantially perpendicular to the plane and release the clamping force.
8. A multi-axis piezoelectric positioner according to any one of the preceding claims, wherein the releasable clamping mechanisms each comprise a further piezoelectric actuator configured to cooperate with the first mentioned piezoelectric actuator so as to move the moveable part relative to the fixed part along a direction perpendicular to the plane while maintaining a clamping force.
9. A multi-axis piezoelectric positioner according to any one of the preceding claims, wherein the moveable part further comprises a carrier coupled to the piezoelectric device and extending along a direction perpendicular to the plane, the carrier having a mounting face to which an object to be positioned may be attached.
10. A multi-axis piezoelectric positioner according to claim 9, wherein the moveable part comprises a second piezoelectric device spaced from the first mentioned piezoelectric device along a direction perpendicular to the plane by an adjustable spacer such that the separation between the first mentioned and second piezoelectric devices is changeable, the carrier being held by the first mentioned and second piezoelectric devices such that it may be moved in a direction perpendicular to the plane by changing the separation of the first mentioned and second piezoelectric devices as the carrier is selectively held and released by the first mentioned and second piezoelectric devices.
11. A multi-axis piezoelectric positioner according to claim 9, wherein the carrier comprises a one-axis positioner such that the position of the mounting face may be positioned along an axis perpendicular to the plane.

-27-

12. A multi-axis piezoelectric positioner according to any one of the preceding claims, further comprising a controller configured to activate the piezoelectric device and the releasable clamp mechanisms in a pre-determined sequence to position the moveable part relative to the fixed part.
- 5 13. A multi-axis piezoelectric positioner according to any one of the preceding claims, further comprising a controller configured to activate the piezoelectric device and the releasable clamping mechanisms in response to a feedback signal to position the moveable part relative to the fixed part.